MAXIMUM THEORETICAL SPECIFIC GRAVITY OF
FIELD PRODUCED BITUMINOUS MIXTURES (RICE TEST)

(A Modification of AASHTO T 209)

SCOPE

1. This method of test is intended for determining the maximum specific gravity of uncompacted bituminous mixtures which have been field produced.

NOTE: Two methods are provided for determining the maximum specific gravity. The method given in Section 6 is for determining results without fan drying the samples. Section 7 describes the procedure which is used when fan drying is necessary. For the first three samples taken at the beginning of production on a project the maximum specific gravity shall be determined in accordance with Section 6 and also shall be fan dried and maximum specific gravity determined in accordance with Section 7. If the difference in resultant air voids, when determined as described in ARIZ 416, Section 9 is greater than 0.2% subsequent samples will be subjected to fan drying. During the course of the project comparisons should be made on approximate 10 sample intervals to determine need for fan drying. In case of dispute, fan drying shall be used.

APPARATUS

2. The apparatus shall consist of the following:

(a) Balance - A balance accurate to 0.1 gram at the maximum weight to be determined.

(b) Container - A heavy walled Erlenmeyer flask having a capacity of at least 1500 ml. strong enough to withstand a partial vacuum; the cover shall consist of a rubber stopper with a tight hose connection. A small piece of No. 200 wire mesh covering the hose opening shall be used to minimize the possibility of loss of fine material.

NOTE: If a procedure which subjects multiple flasks to a vacuum simultaneously is used, the vacuum gauge shall be placed beyond the last bottle to insure that all the bottles are being subjected to the same amount of vacuum.

(c) Glass cover plate large enough to cover mouth of the flask.

(d) Vacuum pump for evacuating air from the container.

(e) Distilled Water - All water used in this procedure shall be distilled water.

CALIBRATION OF FLASK

3. Calibrate the flask by accurately determining the weight of water at 77° ± 1°F required to fill it completely. Use of a glass cover plate is required to ensure accurate filling. Record the weight of the flask + water to the nearest 0.1 gram as "B".

PREPARATION OF SAMPLES

4. (a) Obtain 3 representative 1050 ± 50 gram samples of the material, as described in ARIZ 416.

NOTE: If necessary, heat the sample a maximum of one hour at a maximum temperature of 285°F ONLY until it is pliable enough to allow separation of the coated aggregate.

(b) Spread each sample on a sheet of heavy paper or in a large flat bottom pan. Before the samples are completely cooled separate the particles of the mixture, taking care not to fracture the mineral particles, so that the particles of the fine aggregate portion are not larger than 1/4 inch. Allow the samples to cool to room temperature.

PROCEDURE

5. For each sample the procedure below shall be followed:

(a) Place the sample in the flask and determine weight of sample to the nearest 0.1 gram. This is designated as the "weight of sample in air", or "Wmm".

(b) Add sufficient water, which has been treated with a wetting agent, to cover the sample.

NOTE: A suitable wetting agent such as Aerosol OT in a concentration of 0.01%, or one ml. of 10% solution per 1000 ml. of water, shall be used to facilitate the release of entrapped air.

(c) Remove entrapped air by subjecting the contents of the flask to a partial vacuum, with a minimum of 20 inches mercury for 15 ± 2 minutes. Agitate the contents three or four times within this period, to dislodge trapped air bubbles.

CAUTION: Do not agitate the sample too frequently or vigorously; this can cause stripping of the asphalt film from some particles, resulting in erroneous specific gravities.

(d) After the evacuation period, fill the flask completely with water, slide a preweighed glass cover plate over the mouth of the flask, and weigh immediately to the nearest 0.1 gram. The temperature of the flask, water, and sample shall be between 72°F and 80°F. Record as the weight of the "flask + water + sample", or "C".

CALCULATIONS

6. (a) The Volume of Voidless Mix, "Vvm", in ml. is determined for each sample by the following:

$$Vvm = Wmm + B - C$$

Where: Wmm = Wt. of Sample in Air
B = Wt. of Flask + Water
C = Wt. of Flask + Water + Sample

(b) The Maximum Specific Gravity, "Gmm", is determined for each sample by the following:

$$Gmm = \frac{Wmm}{Vvm}$$

(c) Compare the three individual values for maximum specific gravity. If the range of the three is within 0.024, all are used to determine the average maximum specific gravity as shown in paragraph (d) below. If the range is greater than 0.024, the average of two may be used if they are within a range of 0.012. If values are not achieved within the above criteria, the samples shall be discarded and a set of three new samples shall be tested. If material is not available results should be used cautiously in the analysis of the bituminous mix. If results are used for specification compliance, additional material must be obtained for retesting.

(d) The average maximum specific gravity of the bituminous mix is determined for the samples with acceptable maximum specific gravity values, and recorded to the nearest 0.001 unit.

(e) To determine the maximum density, the average maximum specific gravity is multiplied by 62.3 lbs/cu ft.

PROCEDURE FOR FAN DRYING SAMPLES

7. (a) The entire contents of the flask shall be poured into a nest of sieves consisting of a No. 40 and a No. 200 screen.

NOTE: If stripping has occurred as evidenced by discoloration of water in the flask, significant loss of Minus No. 200 material may be expected. Provisions for the recovery and addition of this material to the Plus No. 200 material shall be made.

(b) Allow mix to drain through the sieves until excessive moisture is removed from mix. Spread the material retained on the No. 40 and No. 200 sieves in a pan and place before an electric fan to remove surface moisture. The air through the fan shall be at room temperature and no heat shall be used to dry the mix.

(c) After evaporation of excess moisture is observed, weigh mix at 15 minutes intervals and when the weight loss is less than 0.5 gram for this interval the mix is considered to be surface dry. Record the surface dry weight as "Wsd". Intermittent stirring of the sample is required during the drying period. Conglomerations of mix shall be broken by hand. Care must be taken to prevent loss of particles of mixture.

NOTE: If the "Wsd" weight for any of the three samples is less than its corresponding "Wmm" weight, the samples shall be discarded and a set of three new samples shall be tested. If material is not available, the maximum specific gravity shall be determined utilizing the "Wmm" weight and results should be used cautiously in the analysis of the bituminous mix. If results are used for specification compliance, additional material must be obtained for retesting.

(d) To calculate the Vvm and maximum specific gravity, Gmm, of each sample, the surface dry weight, Wsd, is substituted for "Wmm" only in the equation given for Vvm in paragraph 6 (a).

EXAMPLE

8. Examples of the calculations are shown in Figures 1 and 2.

LAB. NO.: _88-23456_ DATE: _2-18-88_

PROJECT NO: _F-111-1 (1)_ MATERIAL TYPE: _3/4" A.C._

PROJECT NAME: _BIG GULCH - BUG MOUNTAIN_

TESTED BY: _JOE TESTER_ CHECKED BY: _S.C._

> If samples were fan dried, the maximum density is determined utilizing the "Wsd" weight as below:

FLASK NUMBER	WEIGHT OF FLASK	"Wmm" WEIGHT OF SAMPLE IN AIR	"B" FLASK + WATER	"C" FLASK + WATER + SAMPLE	"Vvm" VOLUME OF VOIDLESS MIX $Wmm+B-C$	"Gmm" MAXIMUM SPECIFIC GRAVITY $\frac{Wmm}{Vvm}$	MAXIMUM DENSITY LBS. PER CU. FT. $62.3 \times Gmm$	"Wsd" SURFACE DRY WEIGHT	"Vvm" VOLUME OF VOIDLESS MIX $Wsd+B-C$	"Gmm" MAXIMUM SPECIFIC GRAVITY $\frac{Wmm}{Vvm}$	MAXIMUM DENSITY LBS. PER CU. FT. $62.3 \times Gmm$
2	1029.8	1029.7	3301.2	3919.2	411.7	2.501		—	—	—	
~~3~~	~~992.7~~	~~1062.6~~	~~3216.2~~	~~3929.1~~	~~419.7~~	~~2.532~~		—	—	—	
4	1178.1	1064.0	3431.9	4071.1	424.8	2.505		—	—	—	
AVERAGE						2.503	155.9			—	—

FLASK NUMBER: _2_ _3_ _4_

REMARKS: _FLASK #3 ELIMINATED FROM THE AVERAGE DUE TO SPECIFIC GRAVITY BEING OUTSIDE SPECIFIED 0.024 ALLOWABLE RANGE._

WT. OF SAMPLE AND FLASK	2059.5	2055.3	2242.1
WT. OF SAMPLE, FLASK, WATER AND GLASS PLATE	4074.3	4084.2	4226.2
WT. OF GLASS PLATE	155.1	155.1	155.1

FIGURE 1

ARIZONA 417

LAB. NO.: _88-2468_   DATE: _2-16-88_

PROJECT NO: _F-888-8 (8)_   MATERIAL TYPE: _1/2" A.C._

PROJECT NAME: _Red Road - Fish Lake_

TESTED BY: _Joe Tester_   CHECKED BY: _S.C._

								If samples were fan dried, the maximum density is determined utilizing the "Wsd" weight as below:			

FLASK NUMBER	WEIGHT OF FLASK	"Wmm" WEIGHT OF SAMPLE IN AIR	"B" FLASK + WATER	"C" FLASK + WATER + SAMPLE	"Vvm" VOLUME OF VOIDLESS MIX $Wmm+B-C$	"Gmm" MAXIMUM SPECIFIC GRAVITY $\frac{Wmm}{Vvm}$	MAXIMUM DENSITY LBS. PER CU. FT. $62.3 \times Gmm$	"Wsd" SURFACE DRY WEIGHT	"Vvm" VOLUME OF VOIDLESS MIX $Wsd+B-C$	"Gmm" MAXIMUM SPECIFIC GRAVITY $\frac{Wmm}{Vvm}$	MAXIMUM DENSITY LBS. PER CU. FT. $62.3 \times Gmm$
1	1184.3	1073.1	3430.2	4071.2	—	—		1073.7	432.7	2.480	
2	1028.9	1093.3	3323.0	3975.7	—	—		1094.0	441.3	2.477	
3	992.4	1090.1	3286.0	3940.6	—	—		1090.7	436.1	2.500	
AVERAGE						—	—			2.486	154.9

FLASK NUMBER:	1	2	3	REMARKS:
WT. OF SAMPLE AND FLASK	2257.4	2122.2	2082.5	
WT. OF SAMPLE, FLASK, WATER AND GLASS PLATE	4216.4	4120.9	4085.8	
WT. OF GLASS PLATE	145.2	145.2	145.2	

FIGURE 2